REMARKS

Reconsideration and allowance of this application are respectfully requested. Currently, claims 1-17 and 20-53 are pending in this application.

Related Application:

The Examiner's attention is again directed to co-pending U.S. Patent Application No. 10/558,673, filed November 30, 2005, including the art cited therein during examination, as well as any past or future USPTO Office Action(s) and/or Applicant Response(s) – several of which have been cited in previously-filed Information Disclosure Statements (IDSs) in the present application.

Applicant notes that a June 11, 2010 Notice of Allowance has been mailed in U.S. Patent Application No. 10/558,673. Applicant assumes that Examiner has access to this Notice of Allowance as well as all other contents of the file wrapper of U.S. Patent Application No. 10/558,673. However, if this assumption is incorrect, Applicant will provide a copy of the Notice of Allowance (or other content) of the file wrapper upon request thereof.

Request of Approval of Drawing Changes:

Applicant filed amendments to the drawings on July 28, 2009 including a replacement sheet of drawings and an annotated sheet showing changes. Applicant requests approval and acceptance of these amendments to the drawings.

Rejection under 35 U.S.C. §101:

Claims 17 and 36-50 were rejected under 35 U.S.C. §101 because these claims were allegedly directed to non-statutory subject matter. As suggested in section 4 (page 2) of the Office Action, these claims have been amended by adding "non-transitory" before "computer

readable storage medium". Applicant therefore requests that the rejection under 35 U.S.C. §101 be withdrawn.

Rejections under 35 U.S.C. §102 and 103:

Claims 1-6, 17, 20-25 and 36-40 were rejected under 35 U.S.C. §102 as allegedly being anticipated by Hu et al (U.S. '538, hereinafter "Hu"). Applicant traverses this rejection.

Anticipation under Section 102 of the Patent Act requires that a prior art reference disclose every claim element of the claimed invention. See, e.g., *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.,* 806 F.2d 1565, 1574 (Fed. Cir. 1986). Hu fails to disclose every claim element of the claimed invention. For example, Hu fails to disclose "matching, by execution of a computer system, sub-field/frame elements of a test video field/frame with corresponding sub-field/frame elements of at least one reference video field/frame, and thereby generating for the test video field/frame a matched reference field/frame comprising the sub-field/frame elements of the at least one reference video field/frame which match to the sub-field/frame elements of the test video field/frame; [and] positioning, by execution of the computer system, in the matched reference video fields/frame at least one of the matching sub-field/frame elements to compensate for misalignment between at least one of the sub-field/frame elements of the test video field/frame and the at least one matching sub-field/frame elements," as required by independent claims 1 and its dependents. Hu also fails to disclose "matching sub-field/frame elements of a test video field/frame with corresponding sub-field/frame elements of at least one reference video field/frame, and thereby generating for the test video field/frame a matched reference field/frame comprising the sub-field/frame elements of the at least one reference video field/frame which match to the sub-field/frame elements of the test video field/frame; [and] shifting, by execution of the computer system, relative to the matched reference field/frame at

least one of the matching sub-field/frame elements to compensate for misalignment between at least one of the sub-field/frame elements of the test video field/frame and the at least one matching sub-field/frame elements," as required by independent claim 17 and its dependents. Similar comments apply to independent claim 20 and its dependents.

Similar to Kuhn (U.S. Patent No. 6,295,083 which is described on page 2 [Background] of the original specification, and was previously and is currently used in a rejection of a least one of the claims), Hu fails to teach the sub field/frame alignment of the invention of the independent claims. Instead, Hu merely discloses alignment of an entire image. This is summarized in the last five lines of Hu's Abstract as follows (emphasis added):

> *"The steps are repeated until an end condition is achieved, at which point the value of the pixel shift position for the test block in the test image relative to the reference image is used to align the two images with high precision sub-pixel accuracy."*

In this respect, Hu is very similar to Kuhn. The description of Hu similarly emphasizes applying a shift to the *entire* image. Alignment between reference and test images is checked using a test block (column 1, line 65 – column 2, line 3 of Hu). Although not identified in Hu, the use of a test block would seem to be for the obvious reason that it allows reliable results to be obtained from the cross-correlation calculations (see column 2, line 60 to column 3, line 20).

However, at no point does Hu describe dividing a reference image into parts and positioning or applying a pixel shift to the part(s) independent of the image as a whole.

This difference between Hu's image alignment detection and invention of the independent claims is that Hu is addressing determination of the displacement of a whole, entire image, not the matching of a plurality of subfield/frames of an image – as presently claimed (see reference to matching "sub-field/frame elements" in the claims – i.e. clearly

requiring more than one). Admittedly, Hu is using only part of a test image and part of a reference image, but these image parts are employed to determine the offset for the entire image and do not reduce adverse effects of sub-field/frame misalignments between the reference and test sequences.

As declared in the introduction to the description on page 2, the inventors were aware of the limitations of the method of Kuhn (U.S. Patent No. 6,295,083) which are very similar to those described in Hu. The invention of the independent claims improves upon these known methods. At page 2, lines 18-23 of the original application, Kuhn and other publications were discussed, as follows (emphasis added):

> *Problems can arise, however, with straightforward comparisons of test and reference sequences to generate the quality metrics mentioned above. For example, spatial or temporal misalignment between the **whole** or parts of the reference and the test sequence can greatly affect such measurements, but may be perceptually insignificant to a human viewer. Such misalignments must be handled if difference measures are to contribute to reliable and practical full reference assessments.*
>
> *Constant spatial and temporal misalignments are commonly encountered in full reference test situations, and can be countered by "one off" alignment applied to the **whole** reference or degraded sequence. Examples of prior art documents which deal with such one off alignments are U.S. Pat. No. 6,483,538, U.S. Pat. No. 6,259,477, U.S. Pat. No. 5,894,324, U.S. Pat. No. 6,295,083, and U.S. Pat. No. 6,271,879. Additionally, field-based spatial or temporal jitter, where misalignments might vary between fields, can be handled by similar techniques applied on a field by field basis. However, more complex, but equally imperceptible, misalignments may also occur **within a field or frame, where different regions of a video field or frame might be subject to different shifts, scaling, or delay**. For example, spatial warping, missing lines, or frozen blocks can occur through video processing and need to be taken into account of if a picture quality assessment metric is to be produced automatically which can be used in place of human subjective testing results.*

These misalignments within a field or frame are simply not dealt with by the teachings of Hu.

In contrast, misalignments within a field or frame are addressed by the invention of the independent claims by positioning or shifting one or more of the matching sub-field/frame elements to compensate for misalignment between the sub-field/frame elements of the test video field/frame and the matching sub-field/frame elements of the matched reference field/frame. According to the invention of the independent claims, the image is modified (not merely shifted) in order to overcome the affects of shifts between parts of images. This is not addressed by the alignment detection method of Hu which teaches detecting shifts only between *whole* images.

The invention of the independent claims relates to the creation of a new matched reference field/frame, which is more than just the shifted version of the reference signal (e.g., as provided by the teachings of Hu). Unlike the cited prior art, where a test region is formed arbitrarily to cover a textured part of the image (column 2, lines 53-59), the invention of the independent claims divides the test array into a plurality of sub field/frame elements and searches (for example) in the reference signal for a "best match" for each sub field/frame element. The "best match" sub field/frame elements are searched for in the reference signal at various offsets to the position of the corresponding sub field/frame element of the test signal and/or across several adjacent fields/frames. Once selected, each "best match" block is copied into the new, matched reference field/frame and shifted, as necessary, into a position matching the position of the corresponding test sub field/frame.

In this way, the invention of the independent claims provides compensation for the complex misalignments that may occur within a field or frame, where different parts of a video field or frame might be subject to different shifts, scaling, or delay. These

misalignments within a field or frame (i.e. affecting a sub-field/frame element) are not addressed by Hu.

The invention of the independent claims provides significant benefits over the teaching of the cited documents, in particular of Hu, as it enables more effective identification of visually significant imperfections in a video signal. By identifying imperfections imperceptible to the human viewer (such as the misaligned image sub-blocks), the invention of the independent claims enables automatic video quality detection to exclude these effects and provide a result better aligned with the experience of a human viewer.

Applicant therefore requests that the rejection under 35 U.S.C. §102 be withdrawn.

Claims 7-10, 26-29 and 41-44 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Hu in view of Wolf et al. (U.S. '492, hereinafter "Wolf"). Claims 11-16, 30-35 and 45-50 have been rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Hu, Wolf and further in view of Kuhn (U.S. '083) Applicant traverses these rejections.

Claims 7-16 depend at least indirectly from claim 1, claims 26-35 depend at least indirectly from claim 20, and claims 41-50 depend at least indirectly from claim 17. All of the comments made above with respect to Hu thus apply equally to claim 7-16, 26-35 and 41-50. Kuhn and/or Wolf fails to resolve the above-described deficiencies of Hu.

Wolf describes a full-reference objective quality assessment method that uses feature extraction followed by quality classification. The feature extraction process requires time-alignment and includes the calculation of "temporal features." Wolf further describes the measurement of various forms of "impairment" based on features extracted from sampled video, including spatial blurring, temporal blurring, etc. The time-alignment and temporal

feature extraction processes of Wolf appear to be frame-based. Wolf fails to achieve or even consider the sub-field/frame elements matching of claim 1, 17 or 20, or the claimed shifting.

The Office Action correctly indicates that Wolf refers to statistical analysis. However, this statistical analysis is not part of the video quality assessment arrangement of Figure 2. The statistical analysis described in Wolf forms part of the development process used to design the video quality measurement system illustrated in Figure 2 (see col. 3, lines 4-6), but does not form part of it. The statistical analysis described in Wolf does not generate the one or more matching statistic values and/or matching vectors of claims 7, 26 and 41, but produces a set of source and destination features which determine the internal functioning of the statistics processors 22, 24, 30, and 32 of the video quality measurement system of Figure 2 (see col. 6, lines 3-13). The statistics processors 22, 24, 30, and 32 do not generate statistical values, but compute a set of source features (col. 4, lines 26-35) and destination features (col. 5, lines 13-29). Despite their names, these functional blocks of Wolf do not perform the invention of dependent claim 7, 26 or 41.

The invention of the independent claims acts to minimize the effects of sub-field/frame misalignments that are imperceptible to the human viewer. Wolf fails to teach or suggest this. These "imperceptible" sub-field/frame misalignments are not so severe as to be noticeable to the human viewer, but can significantly affect the quality value generated by an automatic quality measuring system leading to the generation of inaccurate values. The use of a matching element that is smaller than the video field/frame size enables transient sub-field/frame misalignments to be effectively tracked. This is not identified as being a characteristic of the quality measurement system of Wolf. Indeed, no part of Wolf considers transient sub-field/frame misalignments.

Wolf refers to video frame features from the perspective of bandwidth-reduction. In particular, the source and destination features of Wolf are not sub-fields of a video frame, but bandwidth-reduced representations of the entire frame.

Wolf discloses extraction of features from the video signal being implemented in order to reduce the bandwidth of the signal to allow comparison of signals (source and destination) at geographically remote locations (see col. 3, lines 45-50; col. 5, lines 18-23). According to Wolf, source features are produced by statistics processors 22 and 24 for source video and by statistics processors 30 and 32 for destination video (col. 5, lines 18-21). Col. 5, lines 32-37 discloses that "the system of the [Wolf's] present invention provides human perception-based quality parameters 13 and quality score parameter 14." These features are extracted separately from source and destination videos and exchanged between source and destination "instruments" via a communications channel distinct from the video channel. These features are generated by extracting information from the true video signals and processing that information in the hope of capturing perception-affecting characteristics for comparison.

For all of the above reasons, the invention of the independent claims provides significant benefits over Hu, Kuhn and/or Wolf by enabling more effective identification of visually significant imperfections in a video signal. By identifying imperfections imperceptible to the human viewer (such as the misaligned image sub-blocks), the invention of the independent claims enables automatic video quality detection to exclude these effects and provide a result better aligned with the experience of a human viewer.

Applicant therefore requests that the rejection under 35 U.S.C. §103 be withdrawn.

New claims:

New dependent claims 51-53 have been added. These claims are deemed to be allowable at least for the reasons discussed above with respect to their base independent claims.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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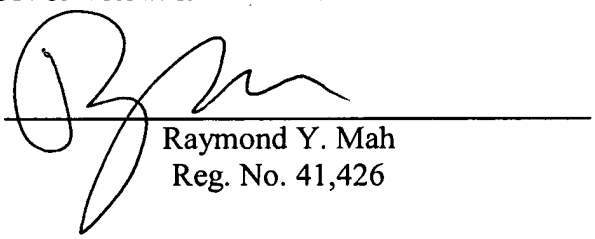
By: 

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